Geographic Information Systems (GIS) at ADOT

Mary Whelan – TPD GIS Team
September 21, 2006

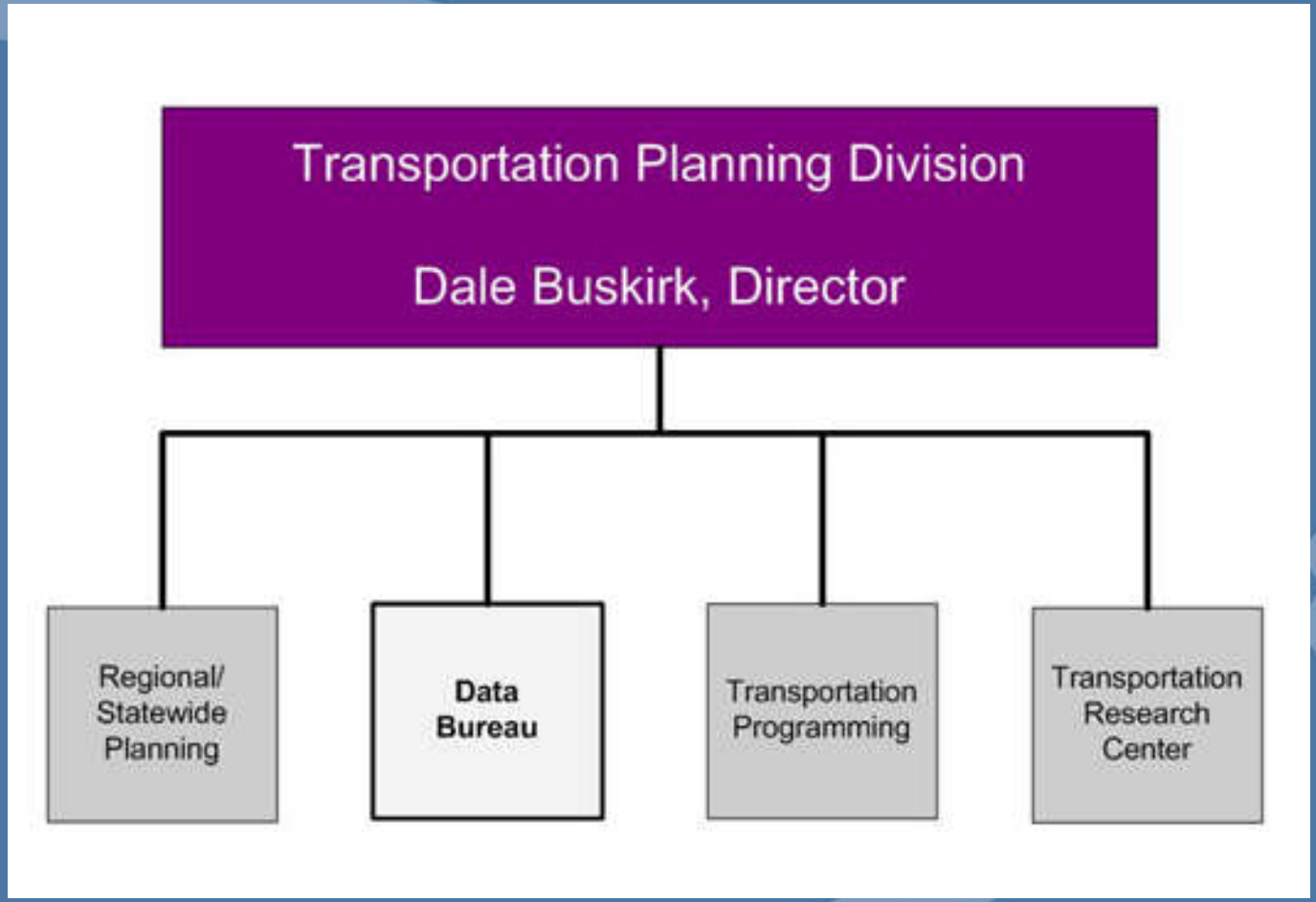
TPD's Mandate within ADOT:

- Provide Transportation Planning
- Coordinate with Local, Regional (COGs), and Tribal Governments
- Priority Programming (5 year plan)
- Conduct Transportation Policy Research
- Provide the Transportation Board and the State Legislature "performance based" measures of the quality and efficacy of the State Transportation System (Data Bureau)

TPD's Mandate within ADOT:

Performance Measures are tied to funding, and must include information on, or measures related to:

- System Preservation
- Congestion Relief
- Accessibility
- Connectivity among Transportation Modes (rail, air, highway, etc.)
- Economic Benefits
- Safety
- Air Quality and Environmental Impacts
- Operational Efficiency and Cost Effectiveness

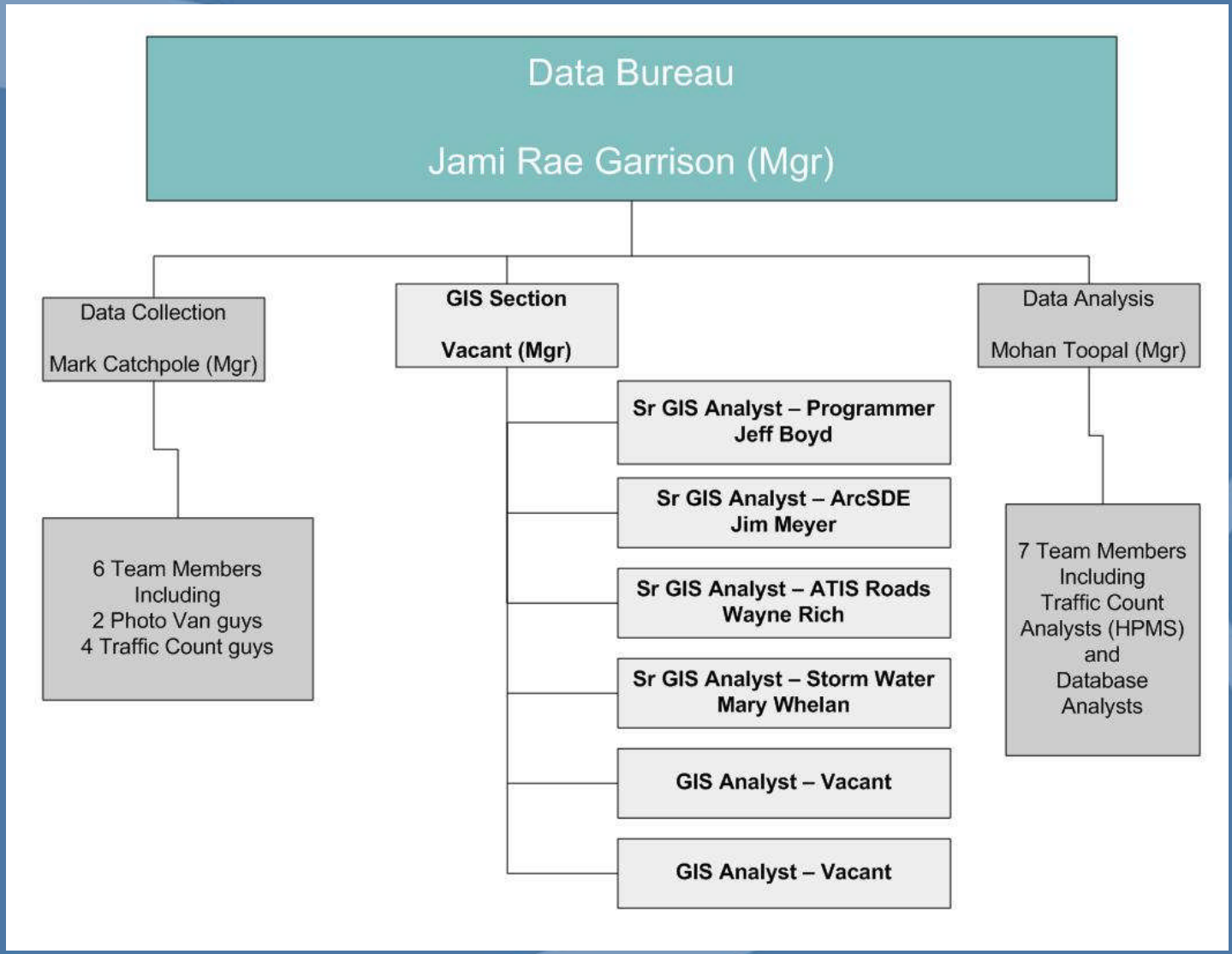

Transportation Planning Division
Dale Buskirk, Director
Regional/ Statewide Planning
Data Bureau
Transportation Programming
Transportation Research Center

The Data Bureau Mandate (*ARS 28-507*):

- TPD is required to develop and maintain a geographically oriented database of existing and planned components of the Transportation System
- GIS job security !

The Data Bureau within TPD:

- Provides data on State Highway extent, use, and performance
- Collects traffic volume data, installs and maintains traffic monitoring equipment
- Tracks changes in highway mileage statistics (e.g., certified public mileage, centerline miles, lane miles, maintenance miles)
- Monitors and documents changes in highway characteristics (e.g., geometrics) that can result from new or re-construction
- Works with data from other ADOT Orgs to provide spatial component to their data (e.g., facilities, assets)
- Collects and analyzes these data using spatial (GIS) and non-spatial databases


Data Bureau
Jami Rae Garrison (Mgr)
Data Collection
Mark Catchpole (Mgr)
6 Team Members
Including
2 Photo Van guys
4 Traffic Count guys
GIS Section
Vacant (Mgr)
Sr GIS Analyst – Programmer
Jeff Boyd
Sr GIS Analyst – ArcSDE
Jim Meyer
Sr GIS Analyst – ATIS Roads
Wayne Rich
Sr GIS Analyst – Storm Water
Mary Whelan
GIS Analyst – Vacant
GIS Analyst – Vacant
Data Analysis
Mohan Toopal (Mgr)
7 Team Members
Including
Traffic Count
Analysts (HPMS)
and
Database
Analysts

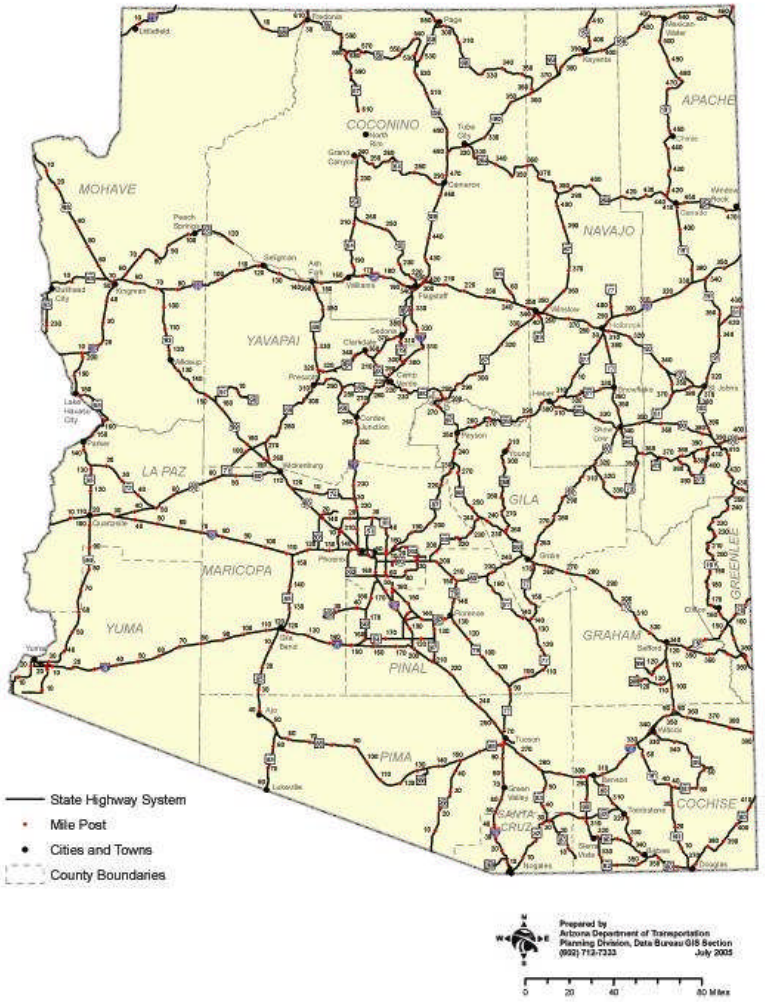
GIS and Data Team
Core Products and Services:

- ATIS Roads (State Highway Centerline GIS)
- Annual Photo Log Inventory of the SHS
- Annual HPMS (Highway Performance Monitoring System) data collection and analysis
- Annual Highway Log data collection and processing
- Graphical (map interface) rendering of the annual updates to the 5 year Priority Program
- GIS support for Storm Water and other Environmental Consent Decrees
- Interactive Web Maps
- Custom maps on request from any ADOT Org
- Annual Map Book
- GIS data files

ATIS Roads

- State Highway Centerline GIS
- Centerlines collected annually on State Highway System using GPS (Photo Log Van)
- Updated from construction plans (CAD, Microstation) and aerial imagery
- Local road centerlines gathered from local agencies as we can get them
- Linear Referencing System (LRS) built on centerline file (Route and Measure)
- Dynamic Segmentation allows attribute data (accidents, pavement condition, AADT, etc.) to be "painted" along correct road segment
- Updated quarterly, posted on the GIS server or contact Wayne Rich
- Used by Data Warehouse for AIDW applications

State Milepost System



ADOT

Arizona Department of Transportation Geographic Information Systems (GIS)

The Data Collection Van featured in July 2006 issue of ADOT *TransSend* on-line magazine

Logging the state highways with modern technology

By Ron Loar
Editor

Take two guys, put them in a van with a digital camera and an array of computer gadgets that are networked to Global Positioning Satellite (GPS) technology and turn them loose with one goal – to photograph every mile of Arizona state highways, north, south, east and west.

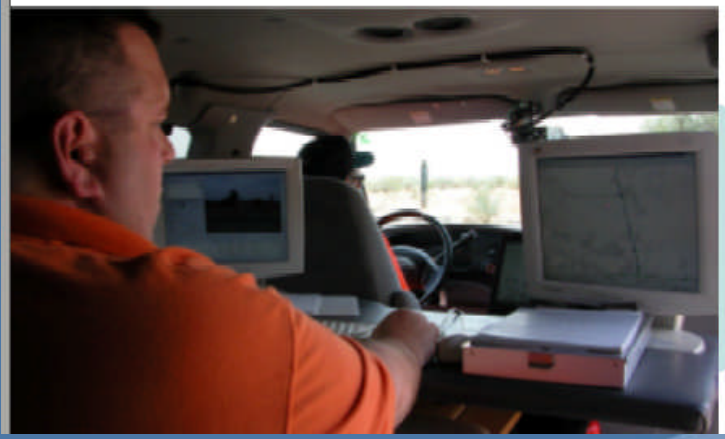
That's exactly what Robert Bush and Tim O'Connor do for ADOT. The two transportation photolog specialists cover more than 20,000 miles a year just to photograph the state and federal highway pavement in Arizona. That's the equivalent of driving round-trip between Los Angeles and Washington, D.C. four times a year.

And, "For what purpose?" you may ask.

Think of it as a video inventory of highways in the state.

The photos are housed in ADOT's – for lack of a better name – Data Warehouse, which is not a warehouse building at all, but a cache of electronic files maintained by the Information Technology Group. When viewed in rapid succession on a computer, the photolog is an electronic record of the highway, much as a driver might see it while driving. In fact, the photolog displays as a movie on the computer. It can be stopped, advanced at a slow rate or fast forwarded, reversed, or even turned around to go back in the opposite direction of travel.

A photolog is a series of sequential photographs, taken from a moving vehicle at driver's eye level, that provides a permanent record of a given highway at a given time. When viewed, the movie shows the number of lanes, surface type and condition, pavement markings, highway signage, signals, intersections, and condition of the highway berm. It also records vegetation growth, advertising signage and structures that potentially may obstruct the view of drivers.



Robert Bush, photolog technician, monitors a center-line map on the right, while the monitor on the left displays the actual photographs and critical data as the photolog process occurs. As the van proceeds along the highway, driver Andy Anderson keeps the photolog specialist apprised of traffic, road and weather conditions.

Images collected – approximately 1.9 million photos each year – are used by various ADOT offices, according to Mark Catchpole, manager of the Data Collection Section of the Transportation Planning Division. The Risk Management office uses the data for litigation defense, as does the Attorney General's office. Materials Group and maintenance engineers can make assessments of roadway conditions from the comfort of their office and without the expense of traveling to make inspections. Signing and Striping crews can readily determine what sections of

(Continued on Page 4)

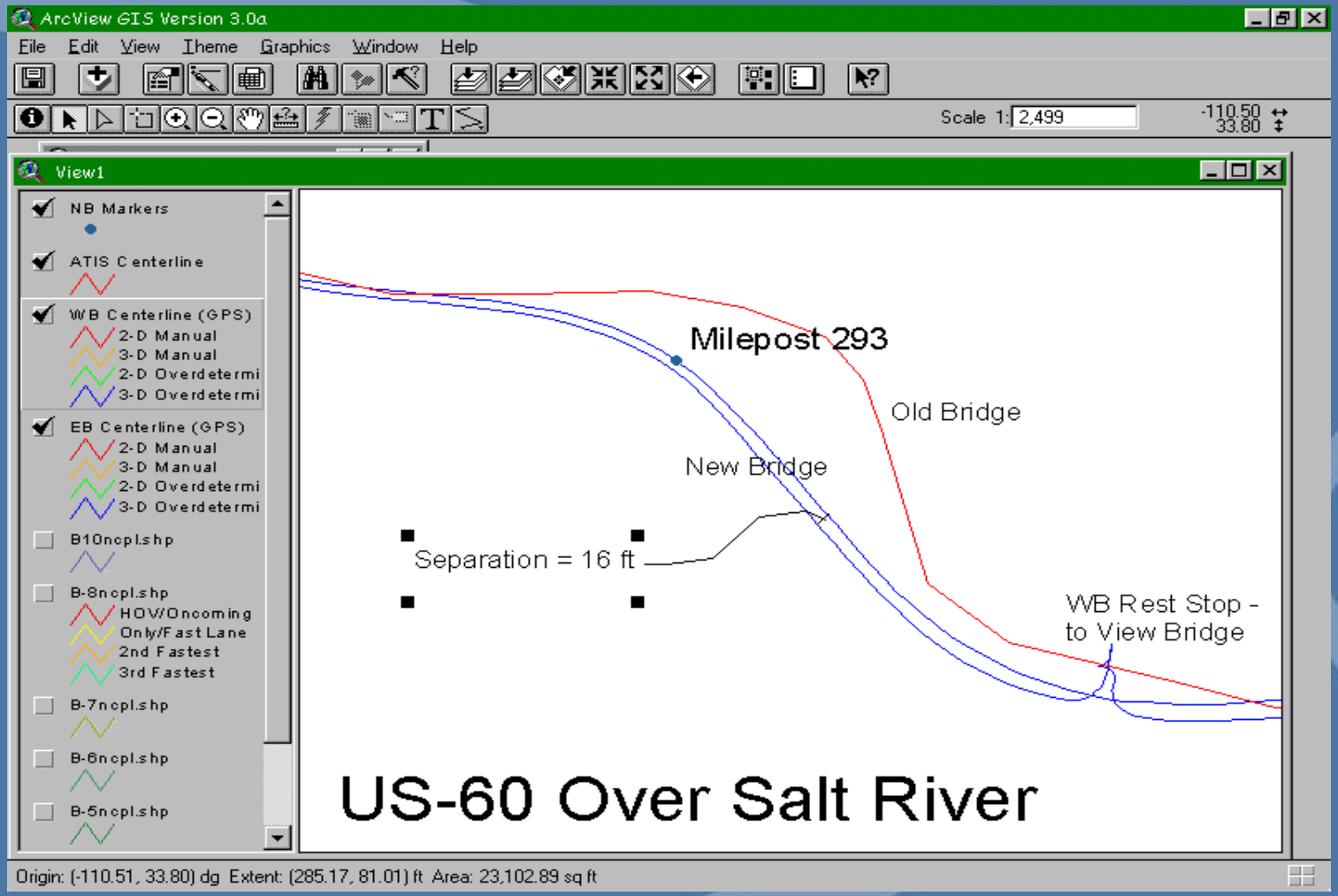
Photo Log Inventory:

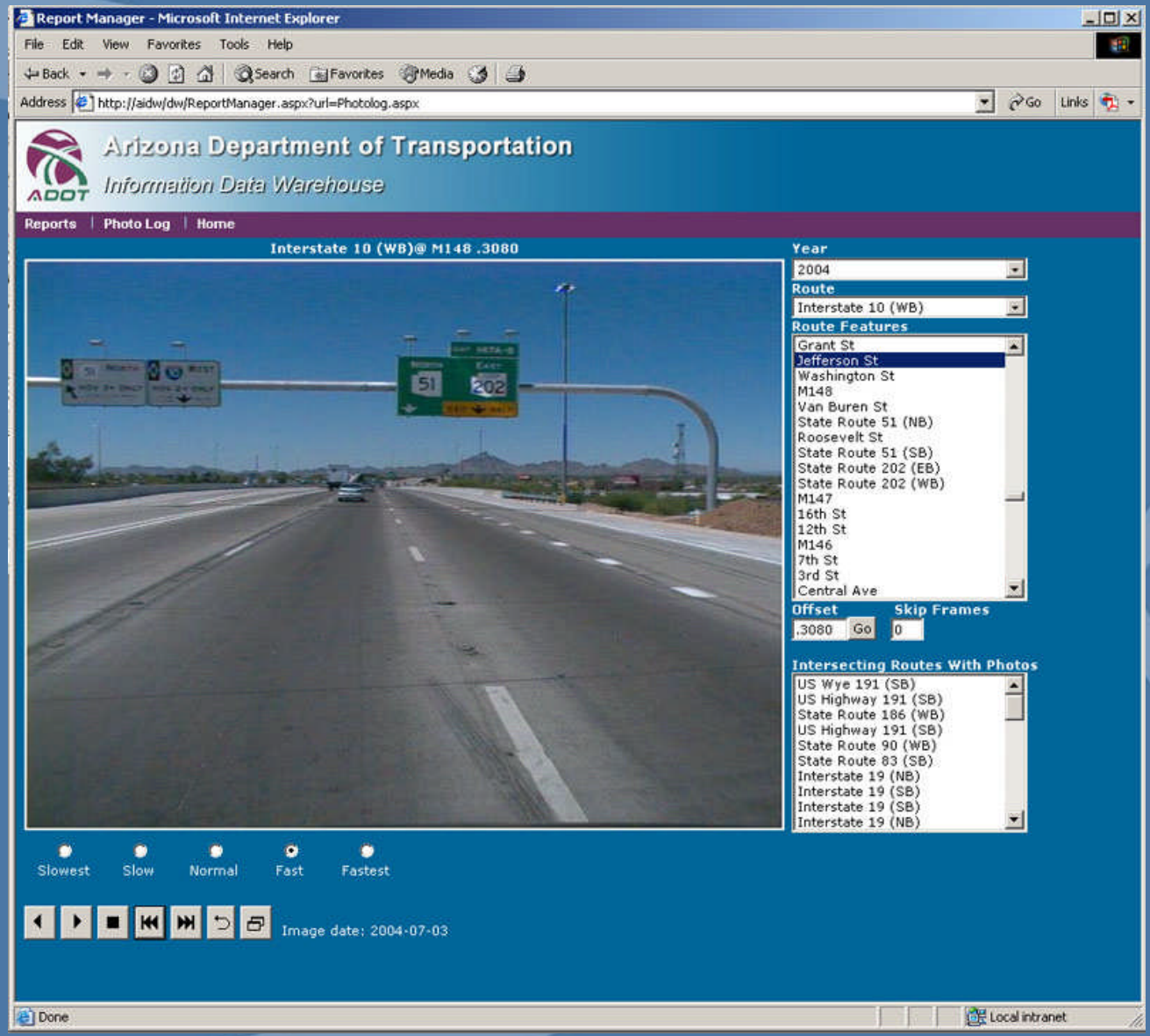
- Annual collection, usually during late spring and summer
- Takes roughly 4 - 5 months to drive the entire State Highway System
- Another 4 - 5 months is spent in the office doing "post-processing" to prepare the data for use by AIDW
- GPS unit collects horizontal and vertical locations as they drive cardinal and non-card directions
- Camera mounted on the windshield takes 132 – 200 photographs per mile, each linked to a GPS position
- Documents road conditions, inventory (signs, striping, guard rails, number of lanes, etc.)
- AIDW application allows user to "drive" the highway system by viewing photographs
- Planned updates to the GPS and camera system will improved resolution and increase the number of features documented

ADOT

Arizona Department of Transportation Geographic Information Systems (GIS)


ViewSonic
29811
Shur-Wipe

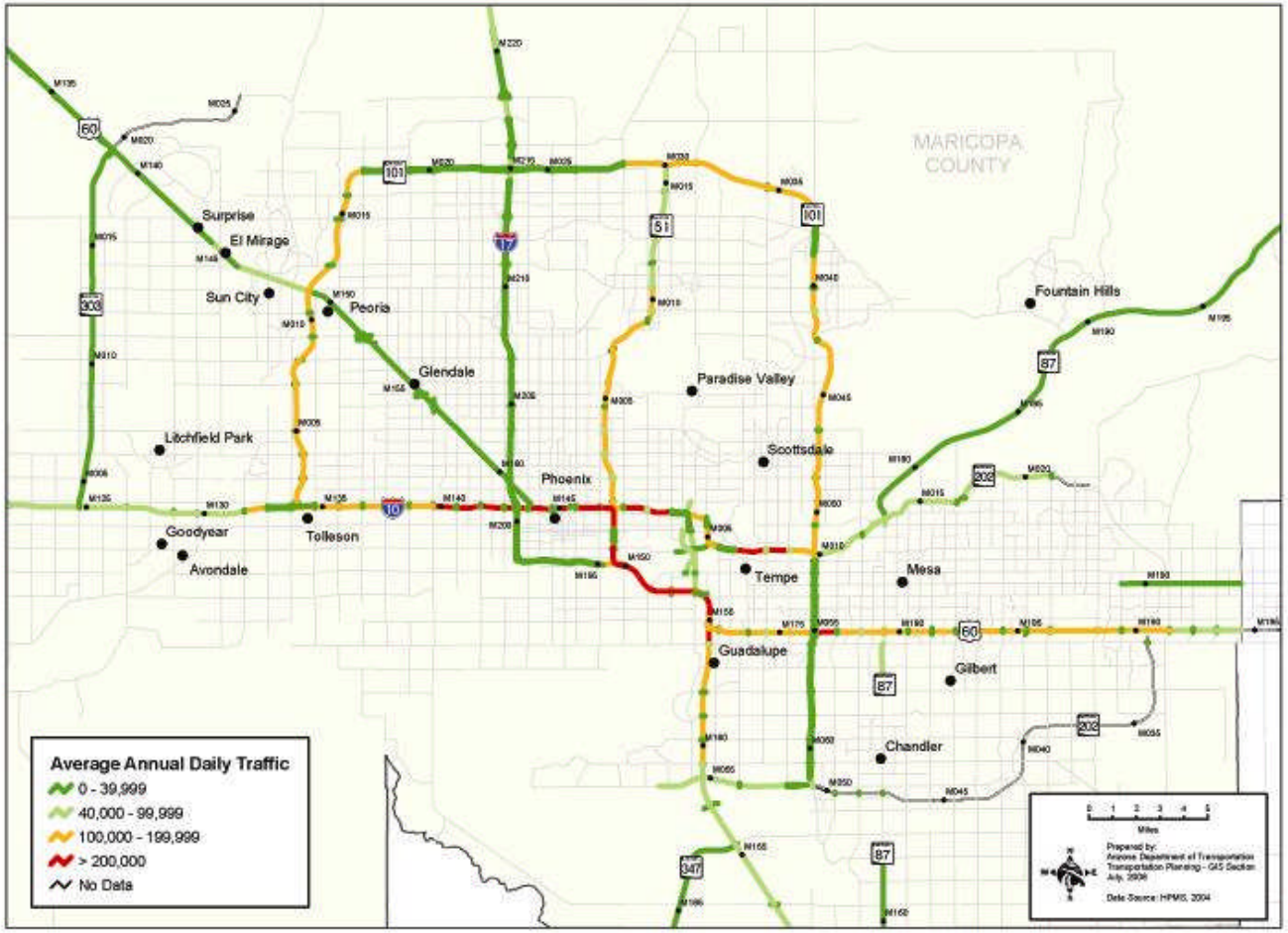

ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 2,499
-110.50
33.80
View1
NB Markers
ATIS Centerline
WB Centerline (GPS)
2-D Manual
3-D Manual
2-D Overdetermi
3-D Overdetermi
EB Centerline (GPS)
2-D Manual
3-D Manual
2-D Overdetermi
3-D Overdetermi
B10ncpl.shp
B-8ncpl.shp
HOV/Oncoming
Only/Fast Lane
2nd Fastest
3rd Fastest
B-7ncpl.shp
B-6ncpl.shp
B-5ncpl.shp
Milepost 293
Old Bridge
New Bridge
Separation = 16 ft
WB Rest Stop -
to View Bridge
US-60 Over Salt River
Origin: (-110.51, 33.80) dg Extent: (285.17, 81.01) ft Area: 23,102.89 sq ft

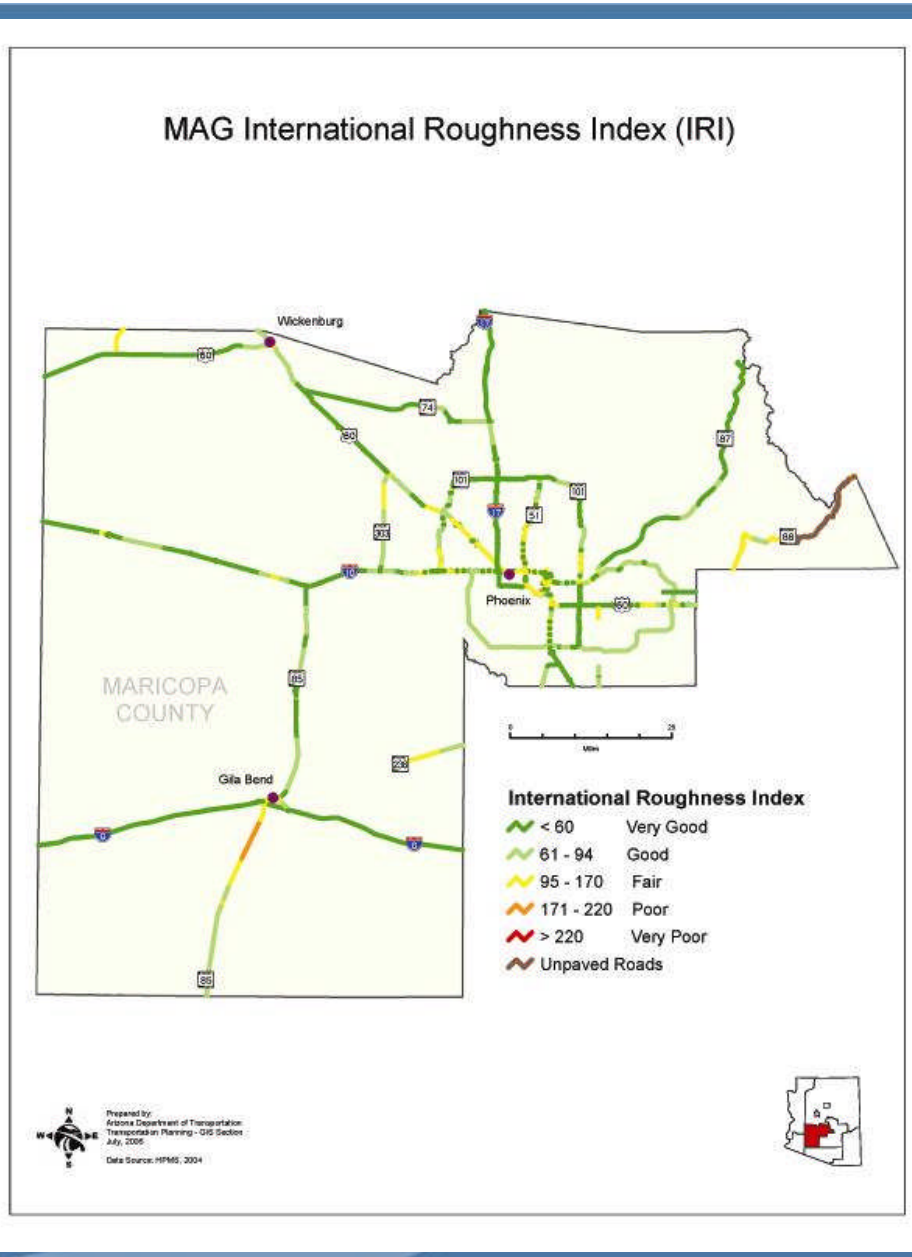

Report Manager - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://aidw/dw/ReportManager.aspx?url=Photolog.aspx
Go Links
Arizona Department of Transportation
Information Data Warehouse
Reports | Photo Log | Home
Interstate 10 (WB)@ M148 .3080
Year
2004
Route
Interstate 10 (WB)
Route Features
Grant St
Jefferson St
Washington St
M148
Van Buren St
State Route 51 (NB)
Roosevelt St
State Route 51 (SB)
State Route 202 (EB)
State Route 202 (WB)
M147
16th St
12th St
M146
7th St
3rd St
Central Ave
Offset
Skip Frames
.3080
Go
0
Intersecting Routes With Photos
US Wye 191 (SB)
US Highway 191 (SB)
State Route 186 (WB)
US Highway 191 (SB)
State Route 90 (WB)
State Route 83 (SB)
Interstate 19 (NB)
Interstate 19 (SB)
Interstate 19 (SB)
Interstate 19 (NB)
Slowest
Slow
Normal
Fast
Fastest
Image date: 2004-07-03
Done
Local intranet

HPMS Database:

- Highway Performance Monitoring System
- Currently being brought in-house to be managed by Data Bureau
- Federally mandated, annual inventory of the national highway system
- Database contains over 80 items, collected on the State Highway System and local roads by ADOT and local partners for FHWA
- Data are used to help allocate Federal and State funding for transportation related projects and programs
- Helps tracks Air Quality compliance for EPA
- Used by TPD Planners to help forecast future transportation needs (HERS-ST)
- Helps ADOT assess the Status and Condition of our roads

Phoenix Metro Area - Average Annual Daily Traffic (AADT)

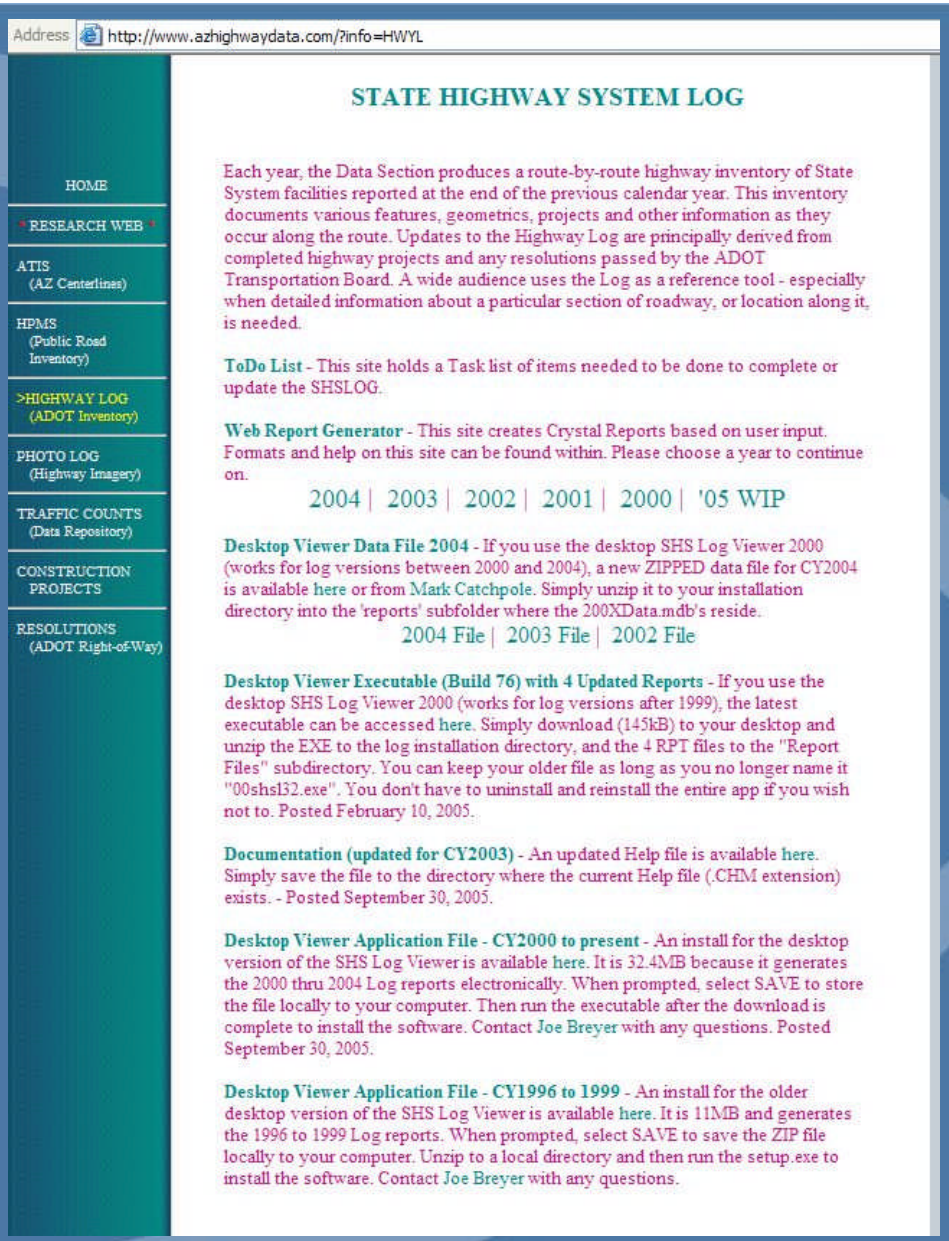


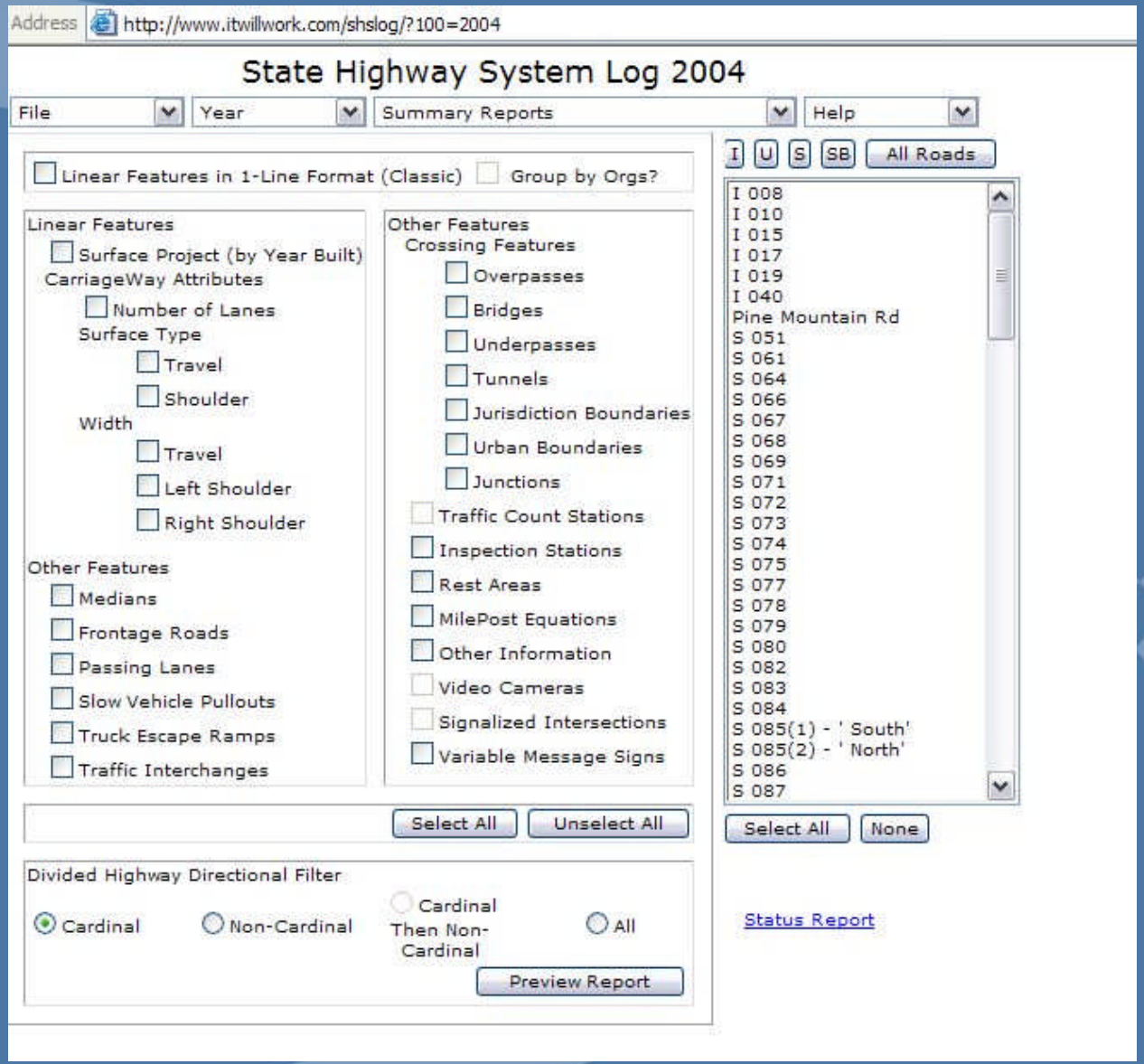

MAG International Roughness Index (IRI)
Wickenburg
Phoenix
Gila Bend
MARICOPA COUNTY
International Roughness Index
< 60 Very Good
61 - 94 Good
95 - 170 Fair
171 - 220 Poor
> 220 Very Poor
Unpaved Roads
Prepared by:
Arizona Department of Transportation
Transportation Planning - GIS Section
July, 2005
Data Source: HPMS, 2004

Highway Log:

- Annual inventory of highway system and some assets (e.g., bridges, median types, shoulder widths, rest areas, passing lanes)
- Currently completed by a consultant
- Being brought in-house over next 2 years
- Only the State Highway System (no local roads)
- More accurate than some data elements in HPMS
- Available for viewing and query at:

www.azhighwaydata.com/?info=HWYL

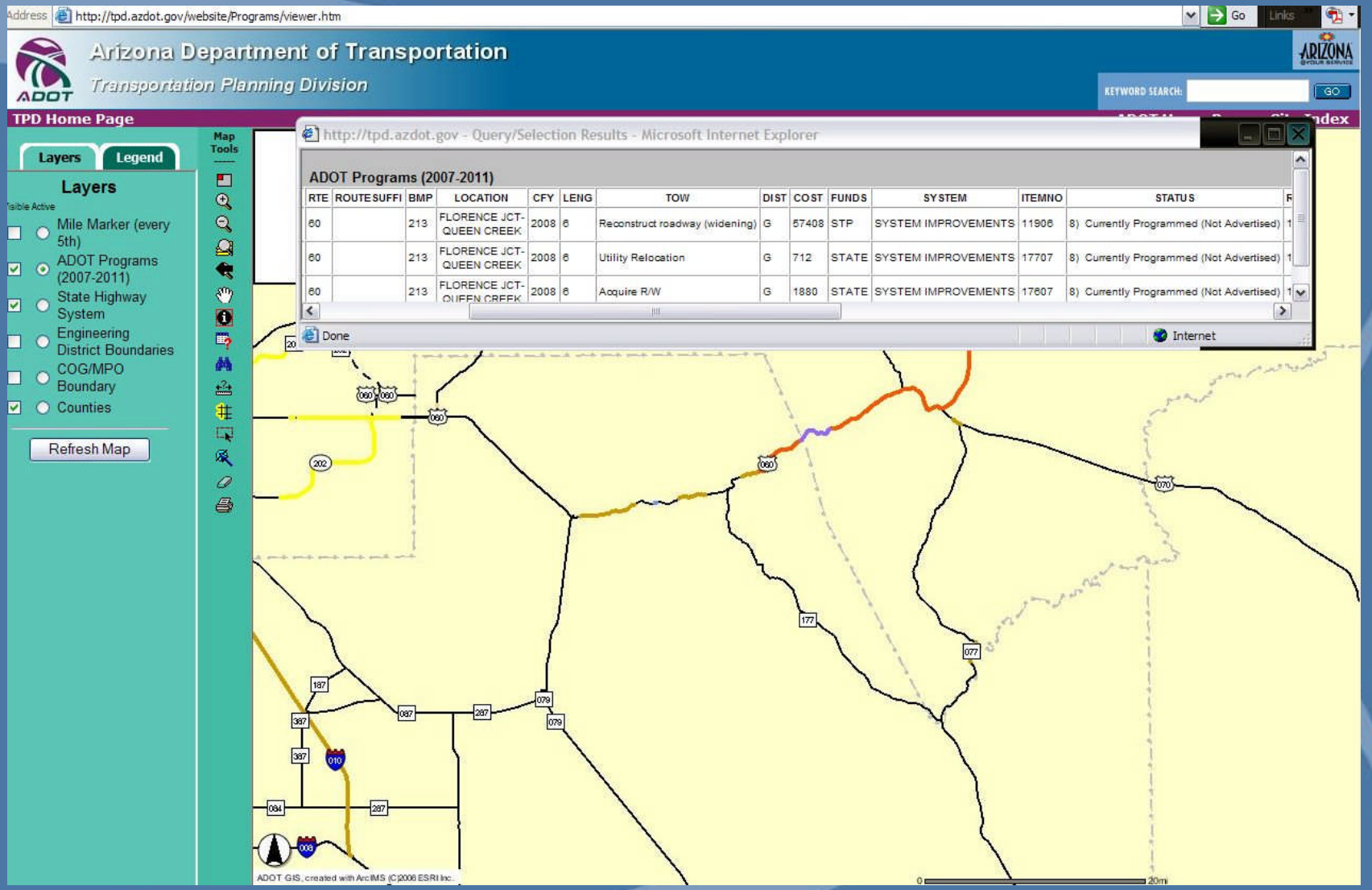

Address http://www.azhighwaydata.com/?info=HWYL
HOME
* RESEARCH WEB *
ATIS (AZ Centerlines)
HPMS (Public Road Inventory)
>HIGHWAY LOG (ADOT Inventory)
PHOTO LOG (Highway Imagery)
TRAFFIC COUNTS (Data Repository)
CONSTRUCTION PROJECTS
RESOLUTIONS (ADOT Right-of-Way)
STATE HIGHWAY SYSTEM LOG
Each year, the Data Section produces a route-by-route highway inventory of State System facilities reported at the end of the previous calendar year. This inventory documents various features, geometrics, projects and other information as they occur along the route. Updates to the Highway Log are principally derived from completed highway projects and any resolutions passed by the ADOT Transportation Board. A wide audience uses the Log as a reference tool - especially when detailed information about a particular section of roadway, or location along it, is needed.
ToDo List - This site holds a Task list of items needed to be done to complete or update the SHSLOG.
Web Report Generator - This site creates Crystal Reports based on user input. Formats and help on this site can be found within. Please choose a year to continue on.
2004 | 2003 | 2002 | 2001 | 2000 | '05 WIP
Desktop Viewer Data File 2004 - If you use the desktop SHS Log Viewer 2000 (works for log versions between 2000 and 2004), a new ZIPPED data file for CY2004 is available here or from Mark Catchpole. Simply unzip it to your installation directory into the 'reports' subfolder where the 200XData.mdb's reside.
2004 File | 2003 File | 2002 File
Desktop Viewer Executable (Build 76) with 4 Updated Reports - If you use the desktop SHS Log Viewer 2000 (works for log versions after 1999), the latest executable can be accessed here. Simply download (145kB) to your desktop and unzip the EXE to the log installation directory, and the 4 RPT files to the "Report Files" subdirectory. You can keep your older file as long as you no longer name it "00shsl32.exe". You don't have to uninstall and reinstall the entire app if you wish not to. Posted February 10, 2005.
Documentation (updated for CY2003) - An updated Help file is available here. Simply save the file to the directory where the current Help file (.CHM extension) exists. - Posted September 30, 2005.
Desktop Viewer Application File - CY2000 to present - An install for the desktop version of the SHS Log Viewer is available here. It is 32.4MB because it generates the 2000 thru 2004 Log reports electronically. When prompted, select SAVE to store the file locally to your computer. Then run the executable after the download is complete to install the software. Contact Joe Breyer with any questions. Posted September 30, 2005.
Desktop Viewer Application File - CY1996 to 1999 - An install for the older desktop version of the SHS Log Viewer is available here. It is 11MB and generates the 1996 to 1999 Log reports. When prompted, select SAVE to save the ZIP file locally to your computer. Unzip to a local directory and then run the setup.exe to install the software. Contact Joe Breyer with any questions.

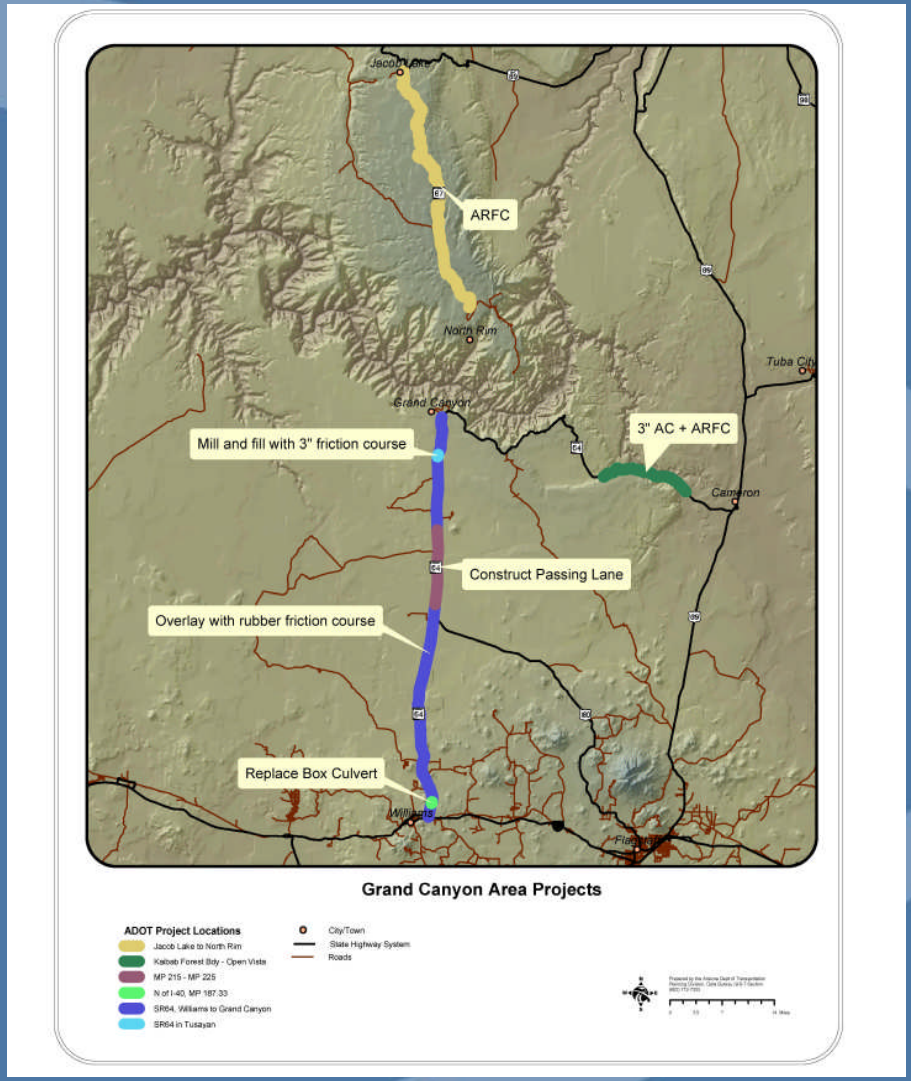

Address
http://www.itwillwork.com/shslog/?100=2004
State Highway System Log 2004
File
Year
Summary Reports
Help
Linear Features in 1-Line Format (Classic)
Group by Orgs?
Linear Features
Surface Project (by Year Built)
CarriageWay Attributes
Number of Lanes
Surface Type
Travel
Shoulder
Width
Travel
Left Shoulder
Right Shoulder
Other Features
Medians
Frontage Roads
Passing Lanes
Slow Vehicle Pullouts
Truck Escape Ramps
Traffic Interchanges
Other Features
Crossing Features
Overpasses
Bridges
Underpasses
Tunnels
Jurisdiction Boundaries
Urban Boundaries
Junctions
Traffic Count Stations
Inspection Stations
Rest Areas
MilePost Equations
Other Information
Video Cameras
Signalized Intersections
Variable Message Signs
Select All
Unselect All
Divided Highway Directional Filter
Cardinal
Non-Cardinal
Cardinal Then Non-Cardinal
All
Preview Report
I
U
S
SB
All Roads
I 008
I 010
I 015
I 017
I 019
I 040
Pine Mountain Rd
S 051
S 061
S 064
S 066
S 067
S 068
S 069
S 071
S 072
S 073
S 074
S 075
S 077
S 078
S 079
S 080
S 082
S 083
S 084
S 085(1) - ' South'
S 085(2) - ' North'
S 086
S 087
Select All
None
Status Report

Web Map of 5 Year Program:

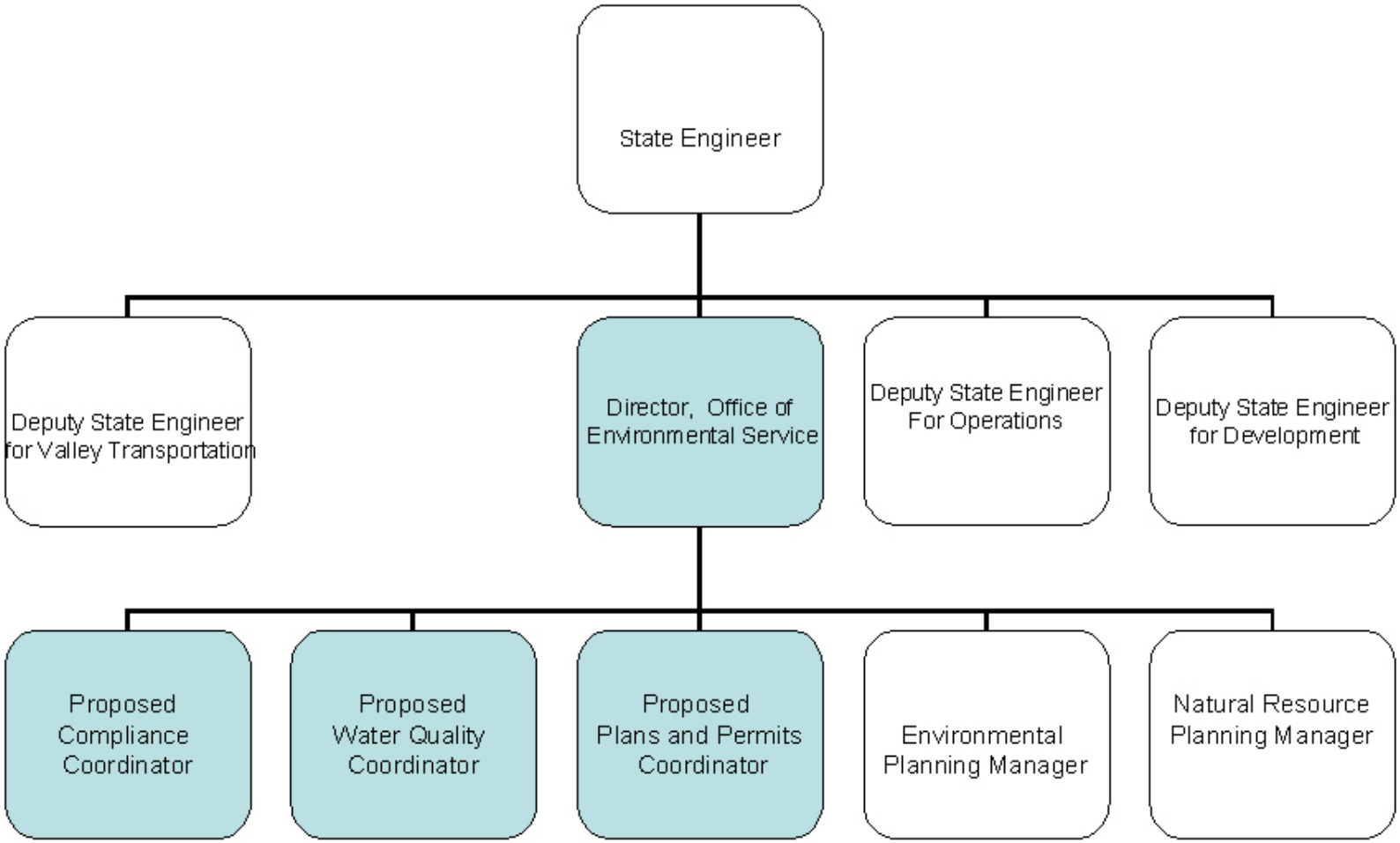
- Graphical (map interface) rendering of the annual updates to the 5 year Priority Program
- Allows user to pan to an area of interest, zoom to a section of Highway, and locate information about planned ADOT projects at that location

http://tpd.azdot.gov/website/Programs/viewer.htm


Address http://tpd.azdot.gov/website/Programs/viewer.htm
Go
Links
Arizona Department of Transportation
Transportation Planning Division
ADOT
ARIZONA
KEYWORD SEARCH:
GO
TPD Home Page
Site Index
Layers
Legend
Map Tools
Layers
Visible Active
Mile Marker (every 5th)
ADOT Programs (2007-2011)
State Highway System
Engineering District Boundaries
COG/MPO Boundary
Counties
Refresh Map
http://tpd.azdot.gov - Query/Selection Results - Microsoft Internet Explorer
ADOT Programs (2007-2011)
RTE | ROUTESUFFI | BMP | LOCATION | CFY | LENG | TOW | DIST | COST | FUNDS | SYSTEM | ITEMNO | STATUS
60 | | 213 | FLORENCE JCT-QUEEN CREEK | 2008 | 6 | Reconstruct roadway (widening) | G | 57408 | STP | SYSTEM IMPROVEMENTS | 11906 | 8) Currently Programmed (Not Advertised)
60 | | 213 | FLORENCE JCT-QUEEN CREEK | 2008 | 6 | Utility Relocation | G | 712 | STATE | SYSTEM IMPROVEMENTS | 17707 | 8) Currently Programmed (Not Advertised)
60 | | 213 | FLORENCE JCT-QUEEN CREEK | 2008 | 6 | Acquire R/W | G | 1880 | STATE | SYSTEM IMPROVEMENTS | 17607 | 8) Currently Programmed (Not Advertised)
Done
Internet
ADOT GIS, created with ArcIMS (C)2006 ESRI Inc.
0
20mi



Arizona Department of Transportation Geographic Information Systems (GIS)


State Engineer
Deputy State Engineer for Valley Transportation
Director, Office of Environmental Service
Deputy State Engineer For Operations
Deputy State Engineer for Development
Proposed Compliance Coordinator
Proposed Water Quality Coordinator
Proposed Plans and Permits Coordinator
Environmental Planning Manager
Natural Resource Planning Manager

Storm Water GIS Support:

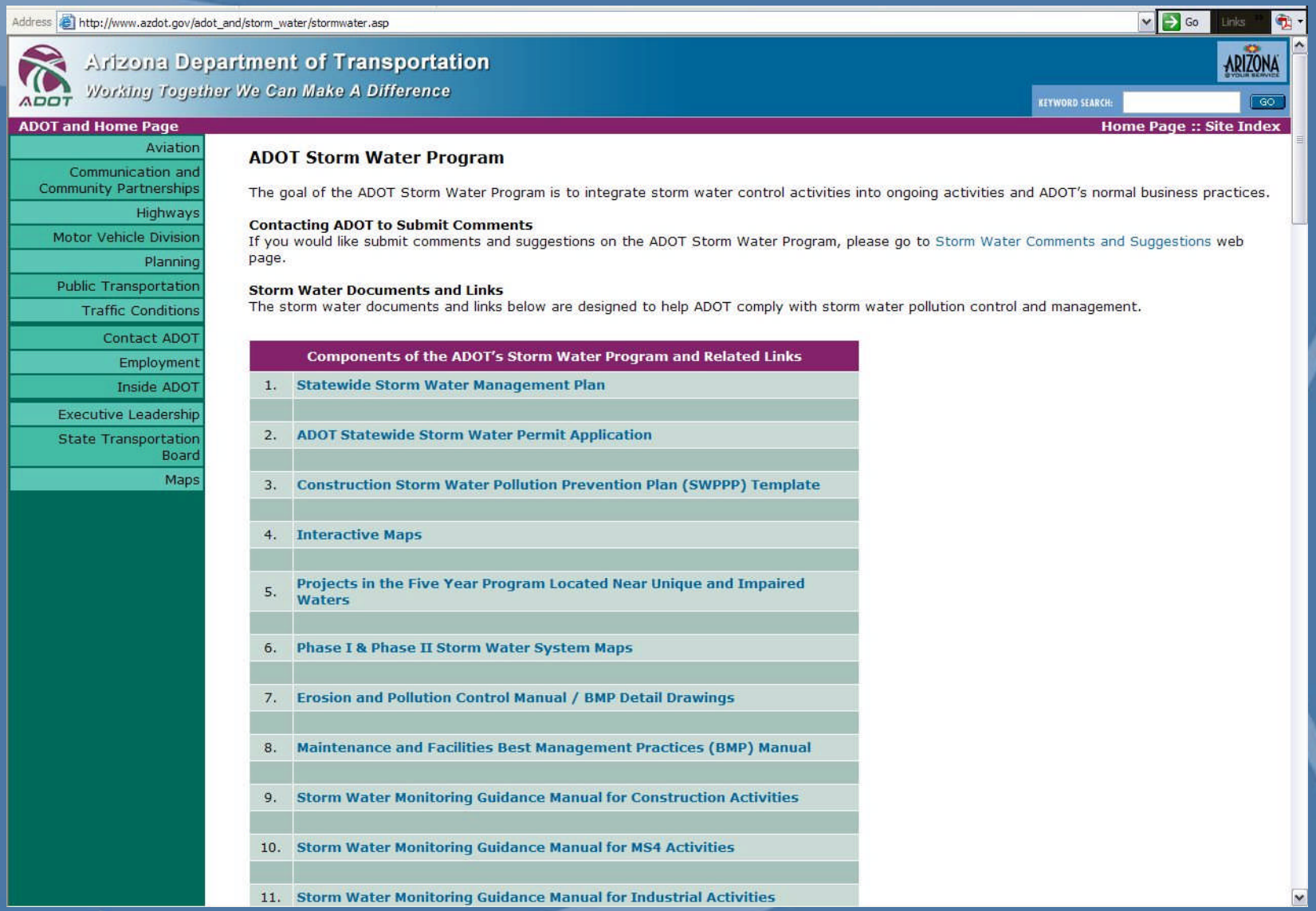
- Storm Water Information Management SWAT
- Maintain database of Unique, Impaired, and Not Attaining waters
- Provide web maps and custom maps for reports
- Link to 5 year Program and provide support for Construction Group in planning
- Current web maps include:

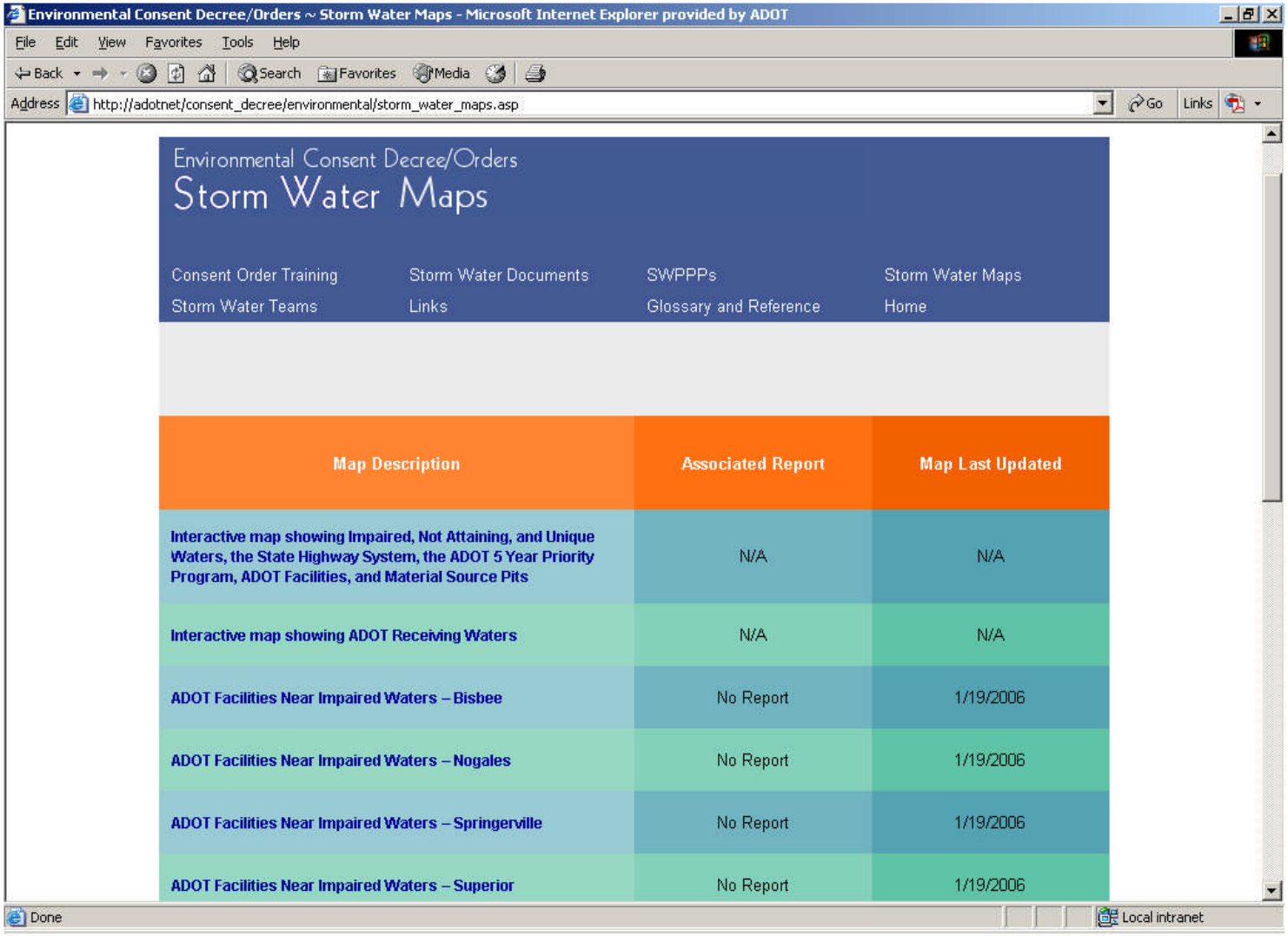
  Impaired etc. Waters interactive map
  http://tpd.azdot.gov/website/waters/viewer.htm

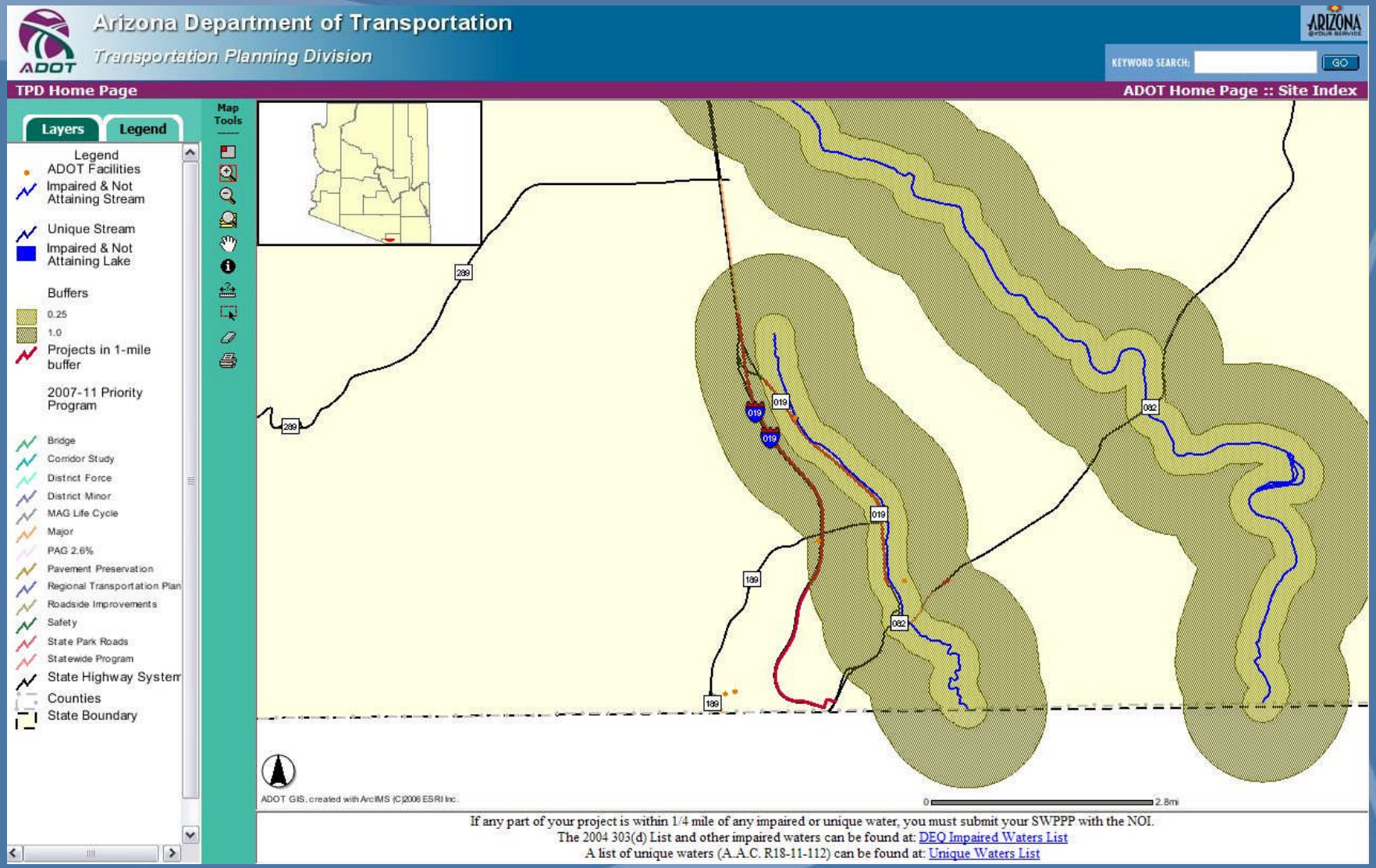
  Receiving Waters interactive map (NHD data)
  http://tpd.azdot.gov/website/receiving_waters/viewer.htm

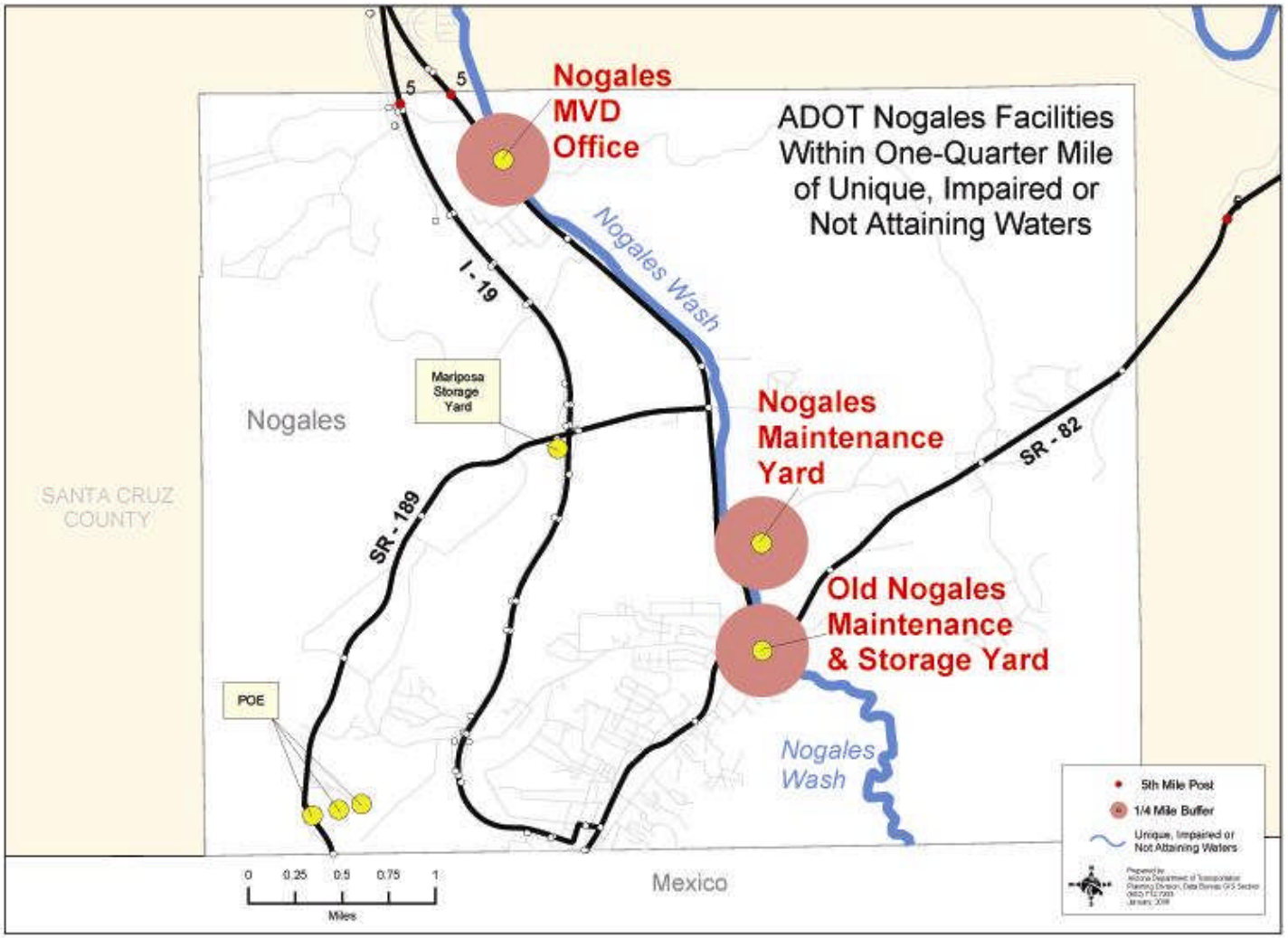
  Adopt-a-Highway interactive map
  http://tpd.azdot.gov/website/kingman/viewer.htm

  Wells interactive map
  http://tpd.azdot.gov/website/wells/viewer.htm

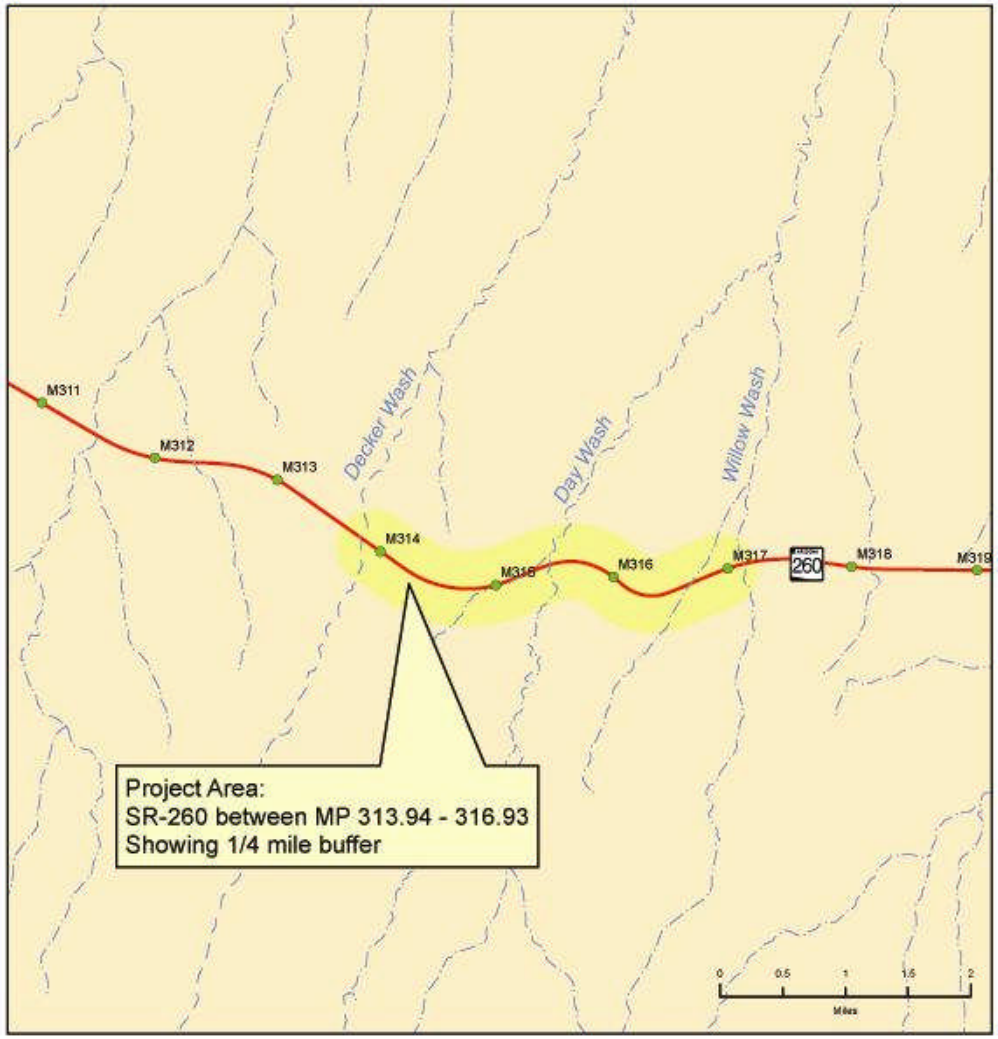

Address http://www.azdot.gov/adot_and/storm_water/stormwater.asp
Go
Links
Arizona Department of Transportation
Working Together We Can Make A Difference
ADOT
ARIZONA
KEYWORD SEARCH:
GO
ADOT and Home Page
Home Page :: Site Index
Aviation
Communication and Community Partnerships
Highways
Motor Vehicle Division
Planning
Public Transportation
Traffic Conditions
Contact ADOT
Employment
Inside ADOT
Executive Leadership
State Transportation Board
Maps
ADOT Storm Water Program
The goal of the ADOT Storm Water Program is to integrate storm water control activities into ongoing activities and ADOT's normal business practices.
Contacting ADOT to Submit Comments
If you would like submit comments and suggestions on the ADOT Storm Water Program, please go to Storm Water Comments and Suggestions web page.
Storm Water Documents and Links
The storm water documents and links below are designed to help ADOT comply with storm water pollution control and management.
Components of the ADOT's Storm Water Program and Related Links
1. Statewide Storm Water Management Plan
2. ADOT Statewide Storm Water Permit Application
3. Construction Storm Water Pollution Prevention Plan (SWPPP) Template
4. Interactive Maps
5. Projects in the Five Year Program Located Near Unique and Impaired Waters
6. Phase I & Phase II Storm Water System Maps
7. Erosion and Pollution Control Manual / BMP Detail Drawings
8. Maintenance and Facilities Best Management Practices (BMP) Manual
9. Storm Water Monitoring Guidance Manual for Construction Activities
10. Storm Water Monitoring Guidance Manual for MS4 Activities
11. Storm Water Monitoring Guidance Manual for Industrial Activities


Environmental Consent Decree/Orders ~ Storm Water Maps - Microsoft Internet Explorer provided by ADOT
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://adotnet/consent_decree/environmental/storm_water_maps.asp
Go Links
Environmental Consent Decree/Orders
Storm Water Maps
Consent Order Training
Storm Water Documents
SWPPPs
Storm Water Maps
Storm Water Teams
Links
Glossary and Reference
Home
Map Description
Associated Report
Map Last Updated
Interactive map showing Impaired, Not Attaining, and Unique Waters, the State Highway System, the ADOT 5 Year Priority Program, ADOT Facilities, and Material Source Pits
N/A
N/A
Interactive map showing ADOT Receiving Waters
N/A
N/A
ADOT Facilities Near Impaired Waters – Bisbee
No Report
1/19/2006
ADOT Facilities Near Impaired Waters – Nogales
No Report
1/19/2006
ADOT Facilities Near Impaired Waters – Springerville
No Report
1/19/2006
ADOT Facilities Near Impaired Waters – Superior
No Report
1/19/2006
Done
Local intranet


Arizona Department of Transportation
Transportation Planning Division
KEYWORD SEARCH:
GO
TPD Home Page
ADOT Home Page :: Site Index
Layers
Legend
Map Tools
Legend
ADOT Facilities
Impaired & Not Attaining Stream
Unique Stream
Impaired & Not Attaining Lake
Buffers
0.25
1.0
Projects in 1-mile buffer
2007-11 Priority Program
Bridge
Corridor Study
District Force
District Minor
MAG Life Cycle
Major
PAG 2.6%
Pavement Preservation
Regional Transportation Plan
Roadside Improvements
Safety
State Park Roads
Statewide Program
State Highway System
Counties
State Boundary
ADOT GIS, created with ArcIMS (C)2006 ESRI Inc.
0
2.8mi
If any part of your project is within 1/4 mile of any impaired or unique water, you must submit your SWPPP with the NOI.
The 2004 303(d) List and other impaired waters can be found at: DEQ Impaired Waters List
A list of unique waters (A.A.C. R18-11-112) can be found at: Unique Waters List


ADOT Nogales Facilities Within One-Quarter Mile of Unique, Impaired or Not Attaining Waters
Nogales MVD Office
Nogales Maintenance Yard
Old Nogales Maintenance & Storage Yard
Mariposa Storage Yard
POE
Nogales Wash
Nogales Wash
I - 19
SR - 189
SR - 82
Nogales
SANTA CRUZ COUNTY
Mexico
5
5
0 0.25 0.5 0.75 1
Miles
5th Mile Post
1/4 Mile Buffer
Unique, Impaired or Not Attaining Waters

Receiving Waters - SR 260
Milepost 313.94 to Milepost 316.93



Interactive Web Maps:

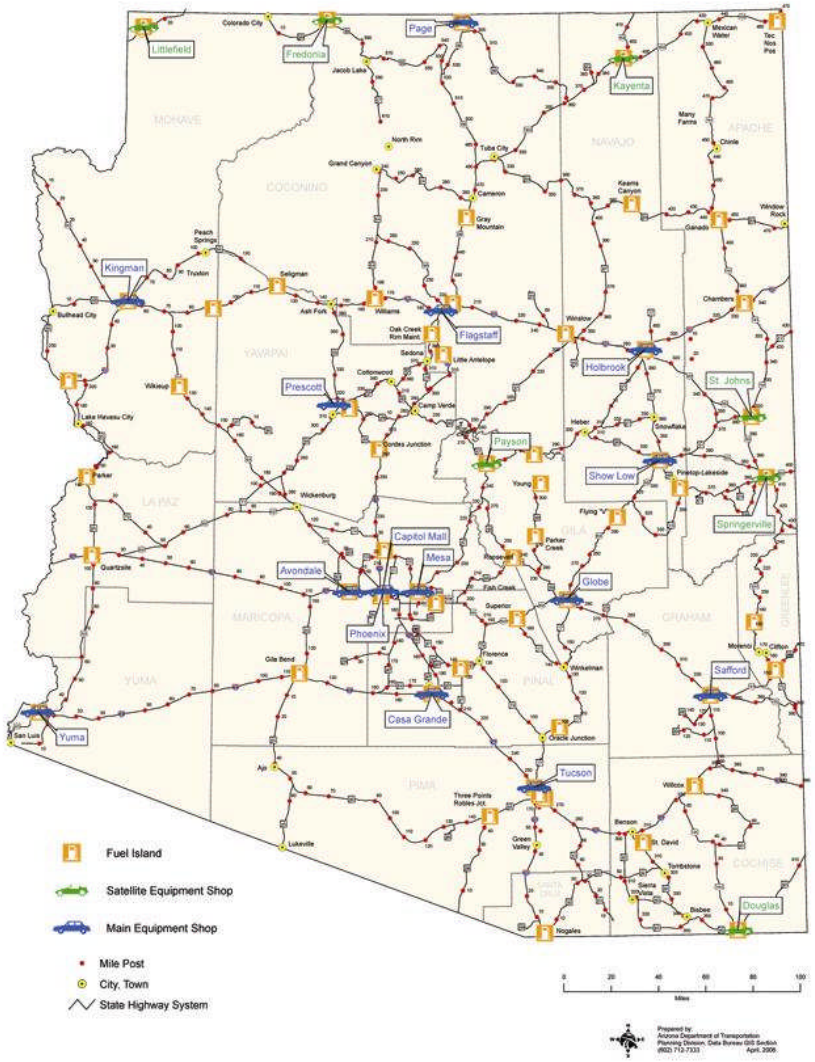
- Available both inside and outside ADOT (inter and intranet)
- Base map shows State Highway System and Mileposts
- Aero map shows statewide distribution of airports
- Web site address:

http://tpd.azdot.gov/website/mapping.htm

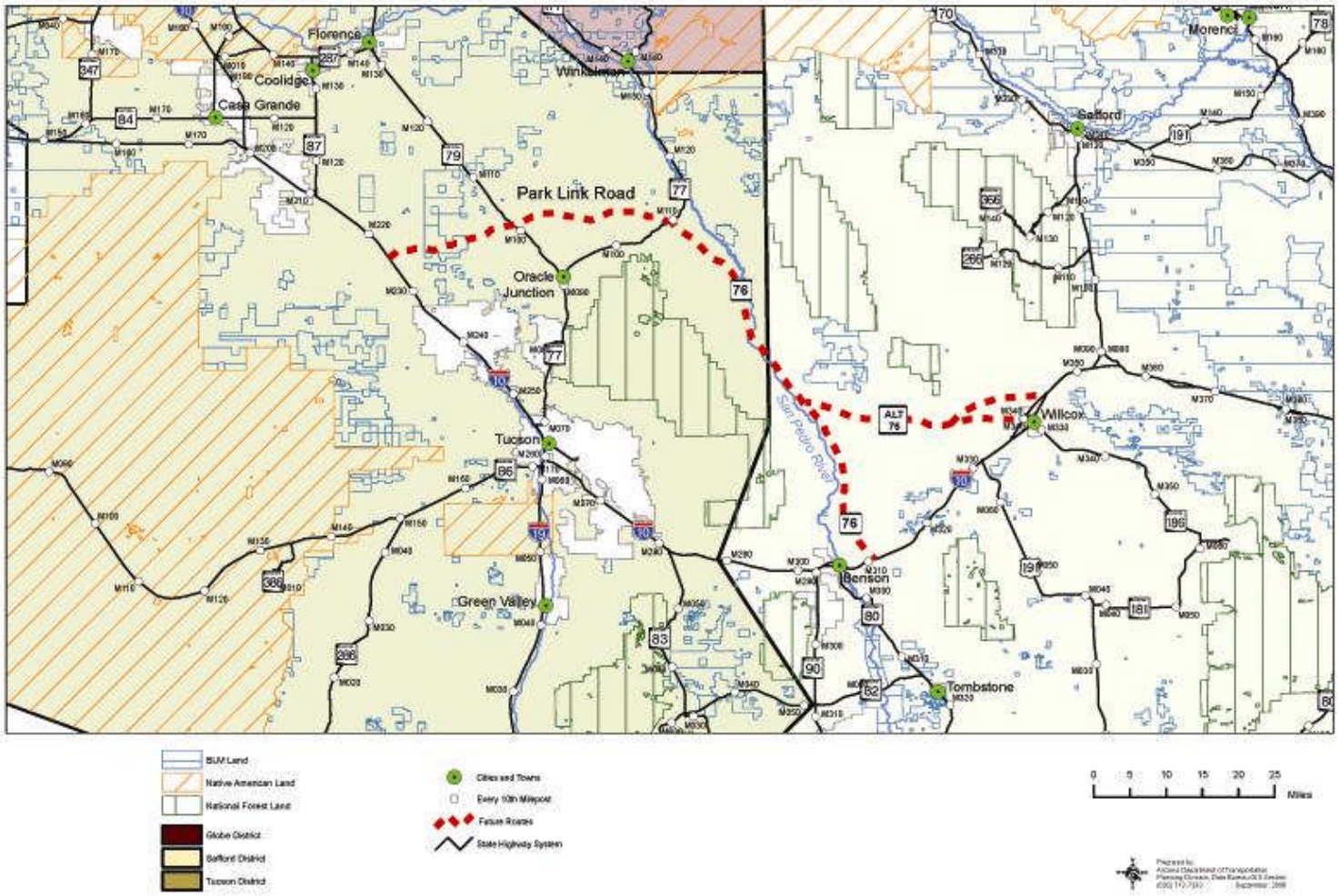
Custom Maps:

- On request (to GIS Team Manager)
- Most of these are on the GIS Server in PDF form at: \\r999ts21\GIS\Maps
- Within reason, we will produce maps on demand for ADOT Orgs
- Email requests to the GIS Manager (or Jami Garrison in the interim)

ADOT Fuel Islands, Full Service and Satellite Equipment Shops



Proposed New Highway Study Routes in Tucson and Safford Engineering Districts

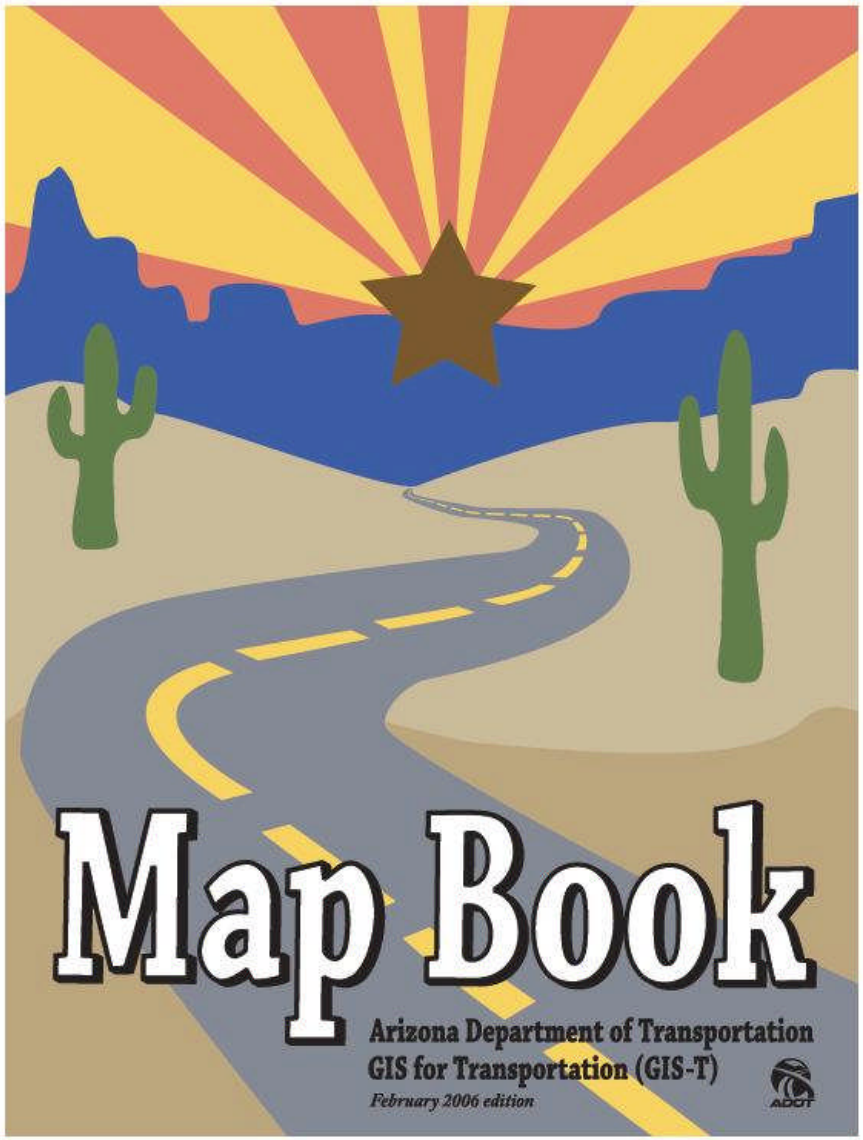


Map Book:

- Annually produce an 8 1/2 X 11 inch book of popular ADOT maps including:

Engineering Districts
Highway System with Mileposts
Ports of Entry
Rest Areas
Scenic Roads
Land Ownership

- Free! Just give me your name and address (ADOT employees) and we'll add you to our mailing list



ADOT

Arizona Department of Transportation Geographic Information Systems (GIS)

GIS Data Files:

- Available on the GIS Server at:
  \\r999ts21\GIS\Data
- Shapefile format primarily
- Includes Environmental as well as State Highway System and Mileposts (ATIS Roads) data, including:

Environmental Data (water, geology)
ADOT Facilities
City, County , COGS boundaries
HPMS
Railroads

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GIS – T
We're Spatial !!

Questions?

Thank You